Lunar Dissipation in Solid Body and Fluid Core

J G Williams, D H Boggs, C F Yoder, J T Ratcliff and J O Dickey
(All at: Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109; 818-354-6466)

The direction of the Moon's precessing polar axis is displaced implying a strong source of dissipation. Lunar laser range analysis now detects three additional small rotation signatures from dissipation. Models with dissipation from solid-body tides and a fluid core/solid mantle boundary are considered. The four periodic signatures are fit best with a tidal specific dissipation Q which has a weak dependence on frequency, Q=37 at one month and Q=60 at one year, plus a core/mantle moment of inertia ratio of 2.1×10^{-4}. If the core is homogeneous, has the density of liquid iron, and interacts turbulently at the core/mantle boundary, then its radius is ≤290 km and its mass is ≤1.0% of the Moon. Adding sulfur to the core would increase the radius limit and decrease the mass limit.